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Boonstra, Anne M.; Reneman, Michiel F.; Stewart, Roy E.; Balk, Gerlof A.

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Life satisfaction questionnaire (Lisat-9): reliability and validity for patients with acquired brain injury

Anne M. Boonstra^a, Michiel F. Reneman^b, Roy E. Stewart^c and Gerlof A. Balk^a

The aim of this study was to determine the reliability and discriminant validity of the Dutch version of the life satisfaction questionnaire (Lisat-9 DV) to assess patients with an acquired brain injury. The reliability study used a test-retest design, and the validity study used a cross-sectional design. The setting was the general rehabilitation centre. There were 159 patients over 18 years of age, with an acquired brain injury, in the chronic phase. The main outcome measures were weighted κ of test and retest data on the nine questions of the Lisat-9 DV and significance levels of differences between subgroups of patients who are expected to differ in terms of Lisat-9 scores, on the basis of other instruments. The results were as follows: the reliability was moderate, with the weighted κ ranging from 0.41 to 0.64. In terms of validity, subgroups of patients who were expected to differ in terms of the Lisat-9 domains did indeed differ significantly, except for the difference in the Lisat score for 'contact with friends and acquaintances' between subgroups defined by higher or lower scores on the corresponding domain of the Frenchay Activities Index. As there was a plausible explanation for not finding a significant difference between subgroups defined by one of the Frenchay Activities Index domains and significant differences were found between the subgroups defined by other instruments corresponding to the same domain, we conclude that the discriminant validity is good. The reliability was not clearly affected by cognitive disorder or aphasia. The conclusions were that the reliability of the Lisat-9 DV for patients with an acquired brain injury was moderate; the discriminant validity was good.

Ziel der vorliegenden Studie war die Ermittlung der Reliabilität und diskriminanten Validität der niederländischen Version des Fragebogens zur Erfassung der Lebenszufriedenheit (Lisat-9 DV) zwecks Beurteilung von Patienten mit erworbenen Gehirnverletzungen. Die Reliabilitätsstudie baute auf einem Test-Retest-Design auf, die Validitätsstudie auf einem Querschnittsdesign. Die Studie wurde in allgemeinen Reha-Zentren durchgeführt. Rekrutiert wurden 159 Patienten im Alter von 18 Jahren und älter mit einer erworbenen Gehirnverletzung in der chronischen Phase. Die wichtigsten verwendeten ergebnisorientierten Messgrößen waren gewichtete κ -Werte der Test- und Retest-Daten aus den neun Fragen des Lisat-9 DV sowie Signifikanzlevels der Unterschiede zwischen Patienten-Subgruppen, die bei den Lisat-9-Scores auf der Basis anderer Instrumente erwartungsgemäß voneinander abweichen. Die Ergebnisse lauteten wie folgt: Die Reliabilität war mittelmäßig, der

gewichtete κ -Wert lag bei 0,41 bis 0,64. Bei der Validität wichen Patienten-Subgruppen, die bei den Lisat-9-Domänen erwartungsgemäß voneinander abweichen würden, in der Tat signifikant voneinander ab mit Ausnahme der Differenz beim Lisat-Score unter 'Kontakt mit Freunden und Bekannten' zwischen Subgruppen, die durch höhere oder niedrigere Scores in der jeweiligen Domäne auf dem Frenchay Aktivitäten-Index definiert wurden. Da es eine plausible Erklärung dafür gab, dass kein signifikanter Unterschied zwischen Subgruppen gefunden werden konnte, die durch eine der Domänen des Frenchay Aktivitäten-Index definiert wurden, und signifikante Unterschiede zwischen den Subgruppen gefunden wurden, die durch andere Instrumente mit Bezug auf die gleiche Domäne definiert wurden, kamen wir zu dem Schluss, dass die diskriminante Validität gut ist. Die Reliabilität war von der kognitiven Störung oder Aphasie nicht wirklich betroffen. Wir folgerten daraus, dass die Reliabilität des Lisat-9 DV für Patienten mit einer erworbenen Gehirnverletzung mittelmäßig war, die diskriminante Validität jedoch gut.

El objetivo de este estudio fue determinar la fiabilidad y la validez discriminante de la versión holandesa del cuestionario de satisfacción con la vida (Lisat-9 DV) para la evaluación de pacientes con lesión cerebral adquirida. El estudio de fiabilidad hizo uso de un diseño test-retest, mientras que el estudio de validez utilizó un diseño transversal. El lugar de realización del estudio fue el centro de rehabilitación general. Participaron 159 pacientes de edad superior a los 18 años que padecían lesión cerebral adquirida en fase crónica. Las principales mediciones que se llevaron a cabo fueron el cálculo del coeficiente κ de los datos de test-retest pertenecientes a las nueve preguntas del Lisat-9 DV y el cálculo de los niveles de significancia de las diferencias existentes entre los subgrupos de pacientes cuyas puntuaciones del Lisat-9 se preveía que difirieran, en comparación con otros instrumentos. Los resultados obtenidos fueron los siguientes: la fiabilidad fue moderada, siendo el valor de κ de entre 0,41 y 0,64. En términos de validez, los subgrupos de pacientes donde se habían previsto discrepancias con respecto a las puntuaciones del Lisat-9 difirieron significativamente, excepto en el apartado relativo a 'contacto con amigos y conocidos' entre subgrupos definidos por puntuaciones superiores o inferiores en el apartado correspondiente del Índice de actividades de Frenchay. Debido a que se presentó una explicación convincente de por qué no se hallaron diferencias significativas entre los subgrupos definidos por uno de los apartados del Índice de

actividades de Frenchay y por qué sí se hallaron diferencias significativas entre los subgrupos definidos por otros instrumentos correspondientes al mismo apartado, se concluye de este estudio que la validez discriminante es buena. La fiabilidad no se vio afectada en modo alguno por ningún trastorno cognitivo o afasia. Del presente estudio se deduce que la fiabilidad del Lisat-9 DV en pacientes con lesión cerebral adquirida fue moderada y la validez discriminante fue buena.

Cette étude avait pour objet de déterminer la fiabilité et la validité discriminante de la version néerlandaise du questionnaire de satisfaction de vie (Lisat-9 DV) pour évaluer les patients souffrant d'un traumatisme cérébral acquis. L'étude de fiabilité utilisait une conception en double test et l'étude de validité une conception transversale. Le cadre était le centre de rééducation général. L'étude portait sur 159 patients de plus de 18 ans, souffrant d'un traumatisme cérébral acquis, en phase chronique. Les principales mesures de résultats étaient le κ pondéré des données de test et de second test pour les neuf questions du questionnaire Lisat-9 DV et les niveaux de signification des différences entre les sous-groupes de patients dont il était attendu qu'ils diffèrent en termes de scores au Lisat-9, sur la base d'autres instruments. Les résultats ont été les suivants : la fiabilité a été modérée, avec un κ pondéré de 0,41 à 0,64. En termes de validité, les sous-groupes de patients dont il était attendu qu'ils diffèrent en termes de domaines Lisat-9 ont effectivement différé sensiblement, sauf pour la différence dans le score

Lisat correspondant au « contact avec vos amis et connaissances » entre les sous-groupes définis par les scores supérieurs ou inférieurs dans le domaine correspondant sur l'indice d'activité Frenchay. Dans la mesure où il existait une explication plausible pour l'absence de différence significative entre les sous-groupes définis par l'un des domaines de l'indice d'activité Frenchay et les différences significatives identifiées entre les sous-groupes définis par d'autres instruments correspondant au même domaine, nous en concluons que la validité discriminante est bonne. La fiabilité n'est clairement pas affectée par les troubles cognitifs ni l'aphasie. Nous en concluons que la fiabilité du questionnaire Lisat-9 DV pour les patients souffrant d'un traumatisme cérébral acquis est modérée ; la validité discriminante est bonne. *International Journal of Rehabilitation Research* 35:153–160 © 2012 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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Keywords: acquired brain injury, life satisfaction, reliability, validity

^a'Revalidatie Friesland' Centre for Rehabilitation, Beetsterzwaag, ^bDepartment of Rehabilitation, Centre for Rehabilitation and ^cDepartment of Health Sciences, Community and Occupational Medicine, University Medical Centre Groningen, University of Groningen, Groningen, The Netherlands

Correspondence to Anne M. Boonstra, PhD, MD, 'Revalidatie Friesland' Rehabilitation Centre, PO Box 2, 9244 ZN Beetsterzwaag, The Netherlands
Tel: +31 512 389 329; fax: +31 512 389 244;
e-mail: a.m.boonstra@revalidatie-friesland.nl

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Introduction

The life satisfaction questionnaire (Lisat-9) was developed by Fugl-Meyer *et al.* (1991) as an instrument to assess life satisfaction. In recent decades, this has been used in the general population (Fugl-Meyer *et al.*, 1991, 2002; Melin *et al.*, 2003) and in multiple patient groups (Viitanen *et al.*, 1988; Heikkilä *et al.*, 1998; Stålnacke *et al.*, 2005; Van Koppenhagen *et al.*, 2008; Silvemark *et al.*, 2008; Hergenröder and Blank, 2009; Sörbo *et al.*, 2009).

Patients with an acquired brain injury (ABI) are often treated at rehabilitation centres, because ABIs, such as stroke and traumatic brain injury, often lead to disabilities. The aim of rehabilitation treatment is to reduce the degree of disability and to improve patients' quality of life, including life satisfaction (Fugl-Meyer *et al.*, 1991). Although the Lisat questionnaire is often used for patients with an ABI (Stålnacke *et al.*, 2005; Vestling *et al.*, 2005; Sörbo *et al.*, 2009; Boosman *et al.*, 2011), studies of its psychometric qualities are lacking. The aim of the present study was to determine the reliability and validity of the Dutch version of Lisat-9 (Lisat-9 DV) for patients with ABI. A secondary question was whether the reliability was affected by the presence of cognitive disorders or aphasia.

The reliability of Lisat-9 DV was studied in a test-retest design, whereas its validity was studied by assessing its discriminant validity. Our hypothesis was that a low satisfaction with 'life as a whole' would be associated with low health-related quality of life (Fuhrer, 2000). A further hypothesis was that satisfaction for particular domains would be low if a patient experienced difficulties with activities corresponding to these domains. For example, if a patient has difficulties relating to their financial situation, we would hypothesize that they would allocate a low score for their satisfaction with their financial situation. As none of the frequently used questionnaires covers all the domains of the Lisat-9, we used several questionnaires for the comparison with Lisat-9 and selected relevant domains or questions and also included self-constructed questions. We hypothesized that the validity of Lisat-9 DV would be good if patients with high versus low scores on other instruments differed significantly in their Lisat scores.

Methods

Patients

The study sample included patients with an ABI, such as stroke, traumatic brain injury or encephalitis, who had been admitted for inpatient or outpatient rehabilitation

treatment to the rehabilitation centre 'Revalidatie Friesland'. This centre is situated in the north of the Netherlands, and has five sites offering outpatient rehabilitation and one site offering inpatient rehabilitation. The inclusion criteria were as follows: age over 18 years; the ABI emerged after 2000 and present for more than 3 months; being admitted for inpatient or outpatient rehabilitation; and giving consent for use of their data for research purposes. The exclusion criteria were insufficient command of Dutch, comorbidity with serious negative consequences for functioning (according to the medical records) or a progressive ABI.

Two groups of patients were included. The first study sample (patient group 1) included patients admitted in 2006 or 2007. Calculations using the data of patient group 1 showed that at least 90 participants would be needed to detect a true weighted κ value of at least 0.65 (using a κ of 0.30 as the H_0). We, therefore, added a second sample (patient group 2) that included other eligible patients treated between 2007 and 2009. All invited participants were informed about the aim and procedures of the study. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Considering the nature of the study, no permission from a regional ethical committee was needed. The local ethical committee approved the study.

Instruments

The Lisat-9 DV is a nine-item self-administered questionnaire including one question about general life satisfaction and eight questions about life satisfaction for the specific domains of 'self-care ability', 'leisure situation', 'vocational situation' (including home-making), 'financial situation', 'sex life', 'relationship with partner', 'family life' and 'contacts with friends and acquaintances'. All nine questions had to be answered on six-point Likert scales (1 = very dissatisfied, 6 = very satisfied). An answer category of 7 = not applicable was introduced for the domains of 'relationship with partner' and 'family life' to match the answer categories of 'have no family' and 'have no steady partner relationship' in the original Lisat-9 (Fugl-Meyer *et al.*, 1991). The Lisat-9 was translated into Dutch in 1998 (Post *et al.*, 1998). The layout of the Lisat-9 was modified for the study of patients with an ABI in that the scores of 1 to 6 were not presented horizontally but vertically and in that the interpretation of the score was shown after each score. The presentation was modified to prevent patients missing part of the score range because of neglect (Price *et al.*, 1999) or forgetting the interpretation of the score because of other cognitive disorders.

The Stroke-Adapted Sickness Impact Profile (SA-SIP30) (Van Straten *et al.*, 2000) consists of 30 questions extracted from the original SIP136 and is stroke-specific. We used the total score of the SA-SIP30 (range 0–30; higher scores reflect more disability) and the domains self-care (range 0–5) and social interaction (range 0–5).

The Nottingham Health Profile (NHP) assesses the health status (De Haan *et al.*, 1993). It consists of 45 questions, which have to be answered by no or yes. We only used the questions about difficulties with 'paid employment', 'looking after the home', 'home life', 'sex life' and 'interests and hobbies' (score range 0–1).

The Frenchay Activities Index (FAI) (Schuling *et al.*, 1993) assesses participation in social activities and instrumental activities of daily living. The FAI consists of 15 items about activities that can be divided into three dimensions: domestic chores, work/leisure and outdoor activities. Summary scores are derived by adding the items, with scores ranging from 0 (no activity) to 45 (highest participation). The FAI was modified to cover not the last 3 months, as in the original FAI, but only the last month (Post and de Witte, 2003). We used the total score and scores on the work/leisure and outdoor activities domains.

The self-constructed questions included questions about possible problems at the time of completing the questionnaire, namely, difficulties with daily and social activities, self-care, financial situation, sex life and relationships with partner and family members. We also asked patients whether they had filled in the questionnaires alone or with help. We assessed the test–retest reliability of these self-constructed questions.

Patients' characteristics were assessed by means of a questionnaire including questions about age (years), sex, marital status (married or living together; single) and educational level (eight levels). Data extracted from the medical files included the type of ABI and the year of onset and whether aphasia (expressive or receptive) or other cognitive disorders were present in the initial phase. The subjective judgement of the rehabilitation physician who had treated the patient in the initial phase or of the researcher (A.M.B) was used to qualify these disorders as not present or as present to a mild, moderate or severe degree. The researcher instructed the physician to use the report of the speech therapist or the psychologist at the end of the treatment. No predefined protocol was used. Three experienced physicians were involved in addition to the researcher.

Procedure

Group 1

After the patients had received the questionnaire for the outcome project, which included the Lisat-9, we sent them a Lisat-9 questionnaire again with a cover letter explaining the aim of the study. Both questionnaires were sent by post. In group 1, we only added the SA-SIP30 and the modified FAI to the outcome measurements.

Group 2

The medical files of patients whose treatment had started in 2007, 2008 or 2009 were checked for inclusion and exclusion criteria and whether patients had died after

admission. As the questionnaires used in group 1 do not cover all Lisat domains, we added questions from the NHP and our self-constructed questions. Eligible patients were sent a letter with an explanation of the study and a first set of the above questionnaires (the long version; see below). If a patient had not returned the questionnaires within 2 weeks and we did not receive a message that the patient had died, changed their address or was not willing to participate, we sent another letter, this time with fewer questionnaires (the short version; see below). If a patient returned the first set of questionnaires, they were sent the second set of questionnaires within 2 weeks. The long version of the first set of questionnaires included all of the above questionnaires (or parts of them as explained above). The short version of the first set included the questions about patient characteristics, the Lisat-9 DV and the SA-SIP30, as well as the question of whether the patient had needed help to fill in the questionnaires. The patients who returned the long version were sent the long version of the second set, whereas the patients who returned the short version were sent the short version. The longer version of the second set of questionnaires included the self-constructed questions, the Lisat-9 DV and the questions selected from the NHP. The short version of the second set included only the Lisat-9 DV.

Statistical analysis

Demographic characteristics and scores on the questionnaires are presented as means with SD, medians and quartiles or percentages, depending on the type of answer category. To enable an external comparison, we also present the percentages of satisfied participants for the satisfaction scores (Fugl-Meyer *et al.*, 1991).

Reliability

Because the nine domain scales of the Lisat-9 DV were measured at the ordinal level, the test-retest reliability of these questions was analysed by means of weighted κ . κ values were considered 'low' when $\kappa < 0.40$, 'moderate' when $0.41 < \kappa < 0.60$, 'substantial' when $0.61 < \kappa < 0.80$ and 'almost perfect' when $\kappa > 0.81$ (Landis and Koch, 1975). We calculated the weighted κ for the total group, and to examine whether the reliability was affected by aphasic or cognitive disorders, we also calculated the weighted κ separately for the patients with and without aphasic or cognitive disorders and for the patients who did or did not need help filling in the questionnaires. For the purpose of this analysis, we dichotomized the degree of aphasia and cognitive disorder into 'without', when aphasia or cognitive disorder was absent or mild, and 'with', when aphasia or cognitive disorder was present to a moderate or a severe degree.

We tested the reliability of the self-constructed questions by means of weighted κ .

It became clear during the analyses, however, that the weighted κ could not be calculated for all comparisons

because of incomplete cell filling. Therefore, the Lisat-9 scores were modified by recoding scores 1 and 2 into 3, so that the cell with the lowest score included more patients. For the self-constructed questions, modification of the scores appeared not to solve the problem of the skewed distribution. Spearman's ρ was calculated to assess their reliability. The correlation coefficients were interpreted as follows: $\rho \leq 0.49$: weak relationship; $0.50 \geq \rho \leq 0.74$: moderate relationship; and $\rho \geq 0.75$: strong relationship (Portney and Watkins, 2009).

Discriminant validity

The validity was tested using the hypothesis that subgroups of patients having or not having difficulties with activities relating to a Lisat-9 domain (according to the other instruments) would differ significantly in the corresponding Lisat-9 score and that patients with a low health-related quality of life would be less satisfied with 'life as a whole' than patients with a higher health-related quality of life. As the nine domain scales of the Lisat-9 were measured at the ordinal level, the Mann-Whitney *U*-test was used to test the differences in Lisat scores between the subgroups defined by higher and lower scores on the other instruments. We used the median split method for scores/questions with ordinal score categories. The method of splitting was chosen before we started the analysis.

The weighted κ values were calculated using SAS, version 9.2 (SAS, Cary, North Carolina, USA), whereas the Mann-Whitney *U*-tests and descriptive statistics were carried out using SPSS, version 16.0 (SPSS, Chicago, Illinois, USA). The significance level was set at *P*-value of 0.05 or less, two-tailed.

Results

A total of 159 patients with ABI were enrolled in the study, 39 patients in study group 1 (estimated response rate 85%) and 120 patients in study group 2 (response rate 64%). Patient characteristics and descriptive statistics of the scores of the questionnaires are summarized in Tables 1 and 2.

Reliability

The reliability of the Lisat-9 proved to be moderate, with weighted κ 's ranging from 0.41 to 0.64 for the unmodified scores and from 0.39 to 0.67 for the modified scores (see Table 3). The weighted κ 's of the patients with aphasia or cognitive disorders were not clearly lower than those of patients without these disorders (ranging from 0.33 to 0.70 for the unmodified scores and from 0.31 to 0.73 for the modified scores). There was also no clear trend towards a lower or a higher weighted κ for the patients who needed help to fill in the questionnaires compared with those who did not need help (ranging from 0.33 to 0.71 for the unmodified scores and from 0.35 to 0.78 for the modified scores). The reliability of our self-constructed questions was moderate to strong, with

Table 1 Demographic and clinical characteristics of patients with ABI in group 1 (*n*=39) and group 2 (*n*=120)

	Group 1	Group 2
Age [years; mean (SD)]	63 (12)	58 (15)
Male (%)	70	63
Marital status		
Married or living with partner (%)	83	77
Education level (%)		
Low	38	39
Intermediate	38	41
High	24	20
Type of ABI (%)		
Ischaemic stroke (left, right, cerebellum)	68 (67, 29, 4)	63 (62, 26, 12)
Haemorrhagic stroke (left, right, cerebellum)	8 (33, 67, –)	11 (29, 57, 14)
Subarachnoid bleeding	5	7
Traumatic brain injury	8	14
Tumour	5	1
Other	5	4
Cognitive functioning at time of rehabilitation (%)		
Not impaired	29	18
Cognitively impaired		
Slightly	34	46
Moderately	32	30
Severely	5	6
Aphasia at the time of rehabilitation		
None	61	70
Present		
Slight	11	12
Moderate	14	13
Severe	14	4
Months between onset and first questionnaire (mean, range)	21, 5–92	41, 11–122
Needing help to fill in the questionnaires (%)	39	41

ABI, acquired brain injury.

weighted κ 's ranging from 0.50 to 0.79 and Spearman's ρ 's ranging from 0.63 to 0.89 (see Table 4).

Validity

The subgroup of patients with higher scores on the other instruments differed significantly in terms of the corresponding Lisat scores from the subgroup with lower scores on the other instruments, except for one (see Table 5): patients with a higher score on the 'outdoor activities' domain in the FAI were more satisfied (i.e. had a higher Lisat score) regarding their contacts with friends and acquaintances than those with a lower score. However, this difference was not significant.

Discussion

The aim of the study was to determine the reliability and validity of the Lisat-9 DV in patients with an ABI treated in a rehabilitation setting. The reliability was moderate, and our data showed no obvious influence of cognitive disorder or aphasia.

The reliability of the Lisat-9 DV was lower than that found in a previous study of patients with chronic pain (Boonstra *et al.*, 2008), where the weighted κ ranged from 0.34 to 0.82, with only a low reliability (weighted κ of 0.34) for family life and a moderate to good reliability

(weighted κ ranging from 0.58 to 0.82) for the other domains. To our knowledge, the reliability of the Lisat-9 has not been studied in other patient groups.

The validity of the Lisat-9 was tested by showing differences between patients who could be expected to differ in terms of items relating to specific domains (discriminant validity), according to other instruments. For all except one domain, we did indeed find significant differences. On the basis of the hypothesized differences between the subgroups with higher and lower scores, we interpret our findings as indicating good validity. This is supported by the magnitude of the differences in the satisfaction scores between the patients of the subgroups. The differences in the Lisat score for satisfaction with 'contacts with friends and acquaintances' between subgroups of patients with higher and lower scores on the social interaction domain of the SA-SIP30 and on the question about disability in 'social activities' were significant, but the difference in the Lisat score between the subgroups of patients defined by higher and lower scores on the outdoor activities domain in the FAI was not. The questions about 'outdoor activities' in the FAI were rated in terms of the frequency of the activities, with the SA-SIP30 domain of 'social interaction' focusing more on the quality of the interaction, whereas our self-constructed questions focused on whether the patient felt disabled. It is possible that the frequency of contacts decreased after an ABI, whereas the quality of the contacts remained the same or decreased less. In view of this plausible explanation, and the fact that the difference was significant in two of the three tests used to compare subgroups, we consider the discriminant validity to be good for this domain too. A good discriminant validity supports good construct validity.

Study limitations

Although our study included a large number of patients, weighted κ s could not be calculated for all domains, especially not in subgroups with a small number of patients. This was because of the fact that most patients reported being rather satisfied, especially about the relationship with their partner (94%) and family life (97%).

We used a modified version of Lisat-9, which could have altered its psychometric properties. However, as the wording of the questions itself was not altered in the modified version, this is unlikely to have affected the validity to a relevant degree. The changes to the scoring method may have altered the reliability, however. The modification was adopted to optimize the reliability for patients with an ABI, but we did not test this assumption. Our validation study of the Lisat-9 used parts of existing questionnaires, and the validity or the reliability of parts of a questionnaire may be different from those of the complete questionnaire. However, use of the complete questionnaires would have been too burdensome for some

Table 2 Lisat-9 scores and scores on other instruments of patients with ABI in group 1 ($n=39$) and group 2 ($n=120$): SA-SIP30, part of NHP and FAI, self-constructed questions (data of the first questionnaire)

	Group 1				Group 2			
	Median (quartiles)	Mean (SD)	Satisfied (%)	n	Median (quartiles)	Mean (SD)	Satisfied (%)	n
Lisat-9								
Life as a whole	4 (4–5)	4.2 (1.0)	44	39	5 (4–5)	4.2 (1.2)	53	120
Self-care	5 (4–6)	4.8 (1.3)	74	39	5 (4–6)	4.7 (1.3)	68	120
Leisure	5 (4–5)	4.6 (0.9)	62	39	5 (4–5)	4.4 (1.1)	52	120
Employment	4 (3–5)	3.9 (1.3)	43	30	4 (2–5)	3.7 (1.5)	40	107
Financial situation	5 (4–5)	4.6 (1.1)	64	39	5 (4–5)	4.4 (1.2)	60	118
Sex life	3 (2–5)	3.5 (1.7)	39	31	4 (2–5)	3.6 (1.6)	46	101
Relationship with partner ^a	6 (5–6)	5.6 (0.6)	94	33	5 (5–6)	5.2 (1.1)	85	98
Family life ^a	6 (5–6)	5.4 (1.0)	97	32	5 (4–6)	5.0 (1.0)	75	97
Contact with friends and acquaintances	5 (5–6)	5.1 (0.7)	87	38	5 (4–5)	4.4 (1.1)	55	119
SA-SIP30								
Total score	6 (1–11)	6.2 (5.2)		39	5 (3–11)	6.8 (5.3)		120
Self-care	0 (0–1)	0.6 (1.2)		39	0 (0–1)	0.8 (1.3)		120
Social interaction	1 (1–3)	1.4 (1.5)		39	1 (1–2)	1.4 (1.3)		120
NHP					Answer yes (%)			
Paid employment					34			83
'Looking after the home'					46			93
Home life					19			92
Sex life					31			84
Interests and hobbies					52			93
FAI								
Total score	37 (31–42)	36.4 (8.1)		33	39 (31–44)	38.0 (9.3)		87
Work/leisure	8 (7–10)	8.5 (2.3)		38	9 (7–11)	9.5 (3.3)		89
Outdoor activities	16 (13–18)	15.4 (3.4)		36	14 (13–18)	14.8 (3.9)		90
Self-constructed questions					Answer 'very good or good' (%)			
Sex life ^a					34			62
Relationship with partner ^a					86			77
Relationship with family members ^a					79			77
					Answer 'no difficulty' (%)			
Daily activities					25			92
Financial situation: making ends meet					72			93
Social activities					4 (1–7)	4.1 (3.3)		93
Self-care					2 (0–6)	3.2 (3.4)		93

ABI, acquired brain injury; FAI, Frenchay Activities Index; Lisat, life satisfaction questionnaire; NHP, Nottingham Health Profile; SA-SIP30, Stroke-Adapted Sickness Impact Profile.

^aAnswer category 'not applicable' treated as missing data.

Table 3 Weighted κ s of the unmodified and modified scores of the life satisfaction questionnaire domains

	n	Weighted κ (95% confidence interval)	
		Unmodified scores	Modified scores
Lisat-9			
Life as a whole	137	0.60 (0.50–0.70)	0.64 (0.54–0.74)
Self-care ability	137	0.59 (0.48–0.70)	0.60 (0.49–0.71)
Leisure situation	137	0.41 (0.30–0.53)	0.39 (0.28–0.50)
Vocational situation	108	0.64 (0.54–0.75)	0.67 (0.57–0.77)
Financial situation	135	0.63 (0.54–0.72)	0.68 (0.59–0.78)
Sex life	112	0.69 (0.61–0.77)	0.73 (0.64–0.82)
Partner relationship	110	–	0.58 (0.45–0.70)
Family life	102	0.46 (0.33–0.59)	0.50 (0.36–0.63)
Contacts with friends and acquaintances	134	0.43 (0.32–0.55)	0.44 (0.32–0.56)

Modified scores meaning that Lisat-9 scores 1 and 2 were recoded to 3.

No weighted κ was calculated because of incomplete cell filling. Lisat-9, life satisfaction questionnaire.

patients, which could have adversely affected the validity or compliance.

We classified the patients' degree of cognitive disorder and aphasia using the data from their medical records at the end of the rehabilitation period, and the classification

was on the basis of subjective judgments. This means that the division of the patients into subgroups on the basis of the degree of cognitive or aphasic disorder was not precise, and the distinction between the subgroups may not have been good enough to find differences between them.

Table 4 Weighted κ s and Spearman's correlation coefficients (ρ) of the scores on the self-constructed questions

	<i>n</i>	Weighted κ (95% confidence limits)	ρ
Self-constructed questions			
Sex life ^a	39	0.79 (0.67–0.91)	0.63
Relationship with partner ^a	56	–	0.71
Relationship with family members ^a	54	–	0.89
Daily activities	69	0.50 (0.36–0.63)	0.63
Financial situation: making ends meet	71	–	0.71
Social activities	69	0.52 (0.38–0.65)	0.65
Self-care	70	0.59 (0.44–0.73)	0.69

No weighted κ was calculated because of incomplete cell filling.

^aAnswer category 'not applicable' treated as missing data.

Table 5 Differences between Lisat-9 scores of the subgroups of patients with lower and higher scores on corresponding domains of SA-SIP30, NHP, FAI and self-constructed questions

Questionnaire question/ domain	Answer categories and range of scores	Split of the population: low versus high scores	Corresponding domain in Lisat-9	Mean difference between Lisat-9 scores of the subgroups with lower and higher scores on the corresponding domain	<i>n</i>	<i>P</i> -value
SA-SIP30	No/yes					
All questions	0–30	0–5 vs. 6–30	Life as a whole	0.9	159	<0.001
Self-care	0–5	0 vs. 1–5	Self-care ability	1.4	159	<0.001
Social interaction	0–5	0–1 vs. 2–5	Contacts with friends and acquaintances	0.5	159	0.01
NHP	No/yes					
Work (paid employment) and 'looking after the home'	0–2	0 vs. 1–2	Employment	1.3	76	<0.001
Home life	0–1	0 vs. 1	Family life	0.7	76	0.006
Sex life	0–1	0 vs. 1	Sex life	2.3	76	<0.001
Interests and hobbies	0–1	0 vs. 1	Leisure	0.9	93	<0.001
FAI	0 (never or none) to 3 (daily or weekly)					
All questions	15–45	≤ 38 vs. ≥ 39	Life as a whole	0.9	98	0.001
Work/leisure	5–15	≤ 9 vs. ≥ 10	Employment	0.9	110	0.006
Outdoor activities	5–15	≤ 15 vs. ≥ 16	Contacts with friends and acquaintances	0.3	126	0.16
Self-constructed questionnaire						
Sex life	Very good to very bad/1–5	1–2 vs. 3–5	Sex life	2.1	60	<0.001
Relationship with partner	Very good to very bad/1–5	1–2 vs. 3–5	Relationship with partner	2.1	76	<0.001
Relationship with family members	Very good to very bad/1–5	1–2 vs. 3–5	Family life	1.0	71	<0.001
Daily activities	No difficulty to very much difficulty/ 0–5	0 vs. 1–5	Employment	1.7	84	<0.001
Financial situation: making ends meet	No difficulty to much difficulty/ 0–5	0 vs. 1–3	Financial situation	2.7	91	<0.001
Social activities	Not disabled to totally disabled/ 0–10	0–4 vs. 5–10	Contacts with friends and acquaintances	0.8	91	0.001
Self-care	Not disabled to totally disabled/ 0–10	0–3 vs. 4–11	Self-care ability	1.2	93	<0.001

FAI, Frenchay Activities Index; Lisat-9, life satisfaction questionnaire; NHP, Nottingham Health Profile; SA-SIP30, Stroke-Adapted Sickness Impact Profile.

Conclusion

The reliability of the Lisat-9 (with modified layout) for patients with an ABI treated in a rehabilitation setting proved moderate for 'life as a whole' and for eight domains. The reliability was not clearly affected by the

presence of cognitive disorders or aphasia. Good discriminant validity was found for the instrument. We recommend using the Lisat-9 in clinical practice and research, although with some caution, as its reliability is 'moderate', rather than 'substantial' or 'good'.

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Conflicts of interest

There are no conflicts of interest.

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